5 December 1966

DEVELOPMENT OBJECTIVES

ADVANCED STEREO RHOMBOID PROTOTYPE MODEL II

1. INTRODUCTION. These Development Objectives describe the requirements to be met in the design and fabrication of a Model II Advanced Stereo Rhomboid Prototype for converting the [redacted] Zoom 70 Stereomicroscope into a high-power microstereoscope. STA

2. CONCEPT. A Model I advanced rhomboid has been developed and is currently in production; however, its usefulness is somewhat limited by its external configuration, which restricts the range of motion of the objective lenses. This development is to eliminate that restriction and incorporate advanced features directed toward expanding the basic concept and creating a more versatile design.

3. REQUIREMENTS.

3.1. Configuration. The rhomboid must fit on any [redacted] Zoom 70 Stereomicroscope that has been modified to take rhomboids fitted with a dovetail slide--presently used to replace the older clip-on version. The external configuration must allow 90° rotation of the Zoom 70 power pod in either direction within its support ring. STA

3.2. Image Separation. The separation between the optical axes of the two objective lenses must be adjustable. In the "X" direction (parallel to viewer's eye base), the maximum separation must be no less than 14 inches and the minimum separation no more than 2 inches. In the "Y" direction (perpendicular to the eyebase), a maximum separation of at least 10 inches in Y is required. Care must be exercised that these large separations are obtained with a minimum addition of bulk; i.e., the units must be as compact as possible when not used at their maximum separation. A telescoping (collimated) system or equivalent alternative should be considered.

3.3. Objective Magnification. Interchangeable sets of objective lenses shall be supplied to provide 1X, 2X, and 3X objective magnification. These objectives must be parfocal and should be designed for quick attachment and removal.

3.4. Monoscopic Viewing. The reflecting prism of the rhomboid attachment must be mounted so that it can be easily removed from the optical path to permit the Zoom 70 to be used as a stereomicroscope without the rhomboid attachment being removed; however, the field of

view of the basic Zoom 70 must not be compromised. It is not mandatory for the instrument to remain in focus when changing from monoscopic to stereoscopic viewing, but a set of monoscopic objectives, equivalent in performance and magnification to the stereoscopic objectives, must be provided. These objectives must also be designed for rapid attachment and removal.

3.5. Image Rotation. Independent, 360° optical image rotation shall be provided in each separate optical path of the rhomboids. The proposal should state: (1) the type of image rotation element contemplated, (2) the error in optical centering that will occur in one total 360° rotation, and (3) the manner in which this error will be measured.

3.6. Resolution. Mounted on a Zoom 70, using the standard 10X eyepieces, and at 3X zoom setting, the attachment must provide the following resolution:

a. 3X objective = 400 lines/mm

b. 2X objective = 300 lines/mm

c. 1X objective = 150 lines/mm

3.7. Field of View. The rhomboid attachment must not restrict the field of view of the basic Zoom 70 at any magnification value. With the 1X objective, the field of view shall be the same as the values listed on page 10 of [redacted] Catalog # 53-70-01-01, with proportional limits for the 2X and 3X objectives.

3.8. Focusing. The left optical path of the rhomboid must incorporate an individual focus adjustment.

3.9. Optical Performance. The optical performance (aberrations) of the rhomboid must not degrade the normal performance of the Zoom 70. The optical system must be designed to permit maximum total light efficiency. The proposal must state the predicted efficiency at all magnifications and describe the system by which this efficiency will be measured.

3.10. Miscellaneous.

3.10.1. Construction. This instrument shall meet the highest commercial standards of microscope construction.

3.10.2. Production. The proposal must include an estimate of production costs for an additional 100 units (in increments of 25). Manufacturing drawings to commercial standards and with sufficient detail to permit quantity production by any competent manufacturer must be supplied with the prototype.

3.10.3. Carrying Case. The proposal must include cost for supplying a carrying case for the instrument.

3.10.4. Instruction Manual. An instruction manual describing proper installation and use of the rhomboids shall be provided. This manual shall conform to the requirements listed in Specification No. DB-1003.

3.10.5. Documentation. Contractual documentation, which conforms to the requirements listed in Specification No. DB-1001, shall be provided.

Specification No. DB-1001
Issue Date: 31 August 1966

CONTRACTUAL DOCUMENTATION TO BE SUPPLIED BY CONTRACTORS

1. SCOPE

1.1 This Specification covers the contractual documentation to be supplied by contractors in the performance of Research and Development contracts.

2. REQUIREMENTS

2.1 General - In order to maintain proper control the progress and funding of Research and Development contracts, it is necessary that certain orderly reporting be accomplished by the Contractor on a regularly scheduled basis.

2.1.1 All documentation submitted by the Contractor shall bear the control number assigned by the Contracting Officer's Technical Representative. This control number shall appear on all correspondence, reports, etc., submitted by the contractor under the contract.

2.2 Types of Reports - The following types of reports shall be submitted by the contractor. Specific reports shall include, but not necessarily be limited to, the designated information.

2.2.1 Monthly - A monthly report shall be prepared as of the last working day of each calendar month. The first monthly report shall be prepared as of the last working day of the first full calendar month subsequent to the date of contract. Monthly reports shall be mailed so as to reach the consignee(s), stated in the contract, not later than the first business day after the fifteenth of the month following the reporting period. Each Monthly report shall provide the following, with negative reporting if applicable.

2.2.1.1 A statement of the activity on the project during the month and the percentage of work completed as of the reporting date.

2.2.1.2 A statement of the planned activity for the next month.

2.2.1.3 A statement of pending, unresolved technical problems.

2.2.1.4 A statement of pending, unresolved contractual problems.

2.2.1.5 A statement for the record, of agreements or understandings reached orally during the reporting period on technical matters not requiring the approval of the Contracting Officer.

2.2.1.6 A statement of any proposed change, agreement or understanding which requires the approval of the Contracting Officer. The contractor is cautioned not to proceed in a situation requiring the prior approval of the Contracting Officer until such approval has been obtained. In situations requiring correspondence with the Contracting Officer, a complimentary copy shall be forwarded, simultaneously, directly to the Contracting Officer's Technical Representative.

2.2.1.7 A statement of unanswered, unresolved matters, unanswered correspondence, etc., and whether delinquency is attributed to the contractor or to the Government.

2.2.1.8 Status of funds. The format shown in Enclosure 1 shall be used to report the status of funds. All applicable items shall be reported. If no expenditures or obligations have been incurred for a specific item, the word "None" shall be entered in the space assigned for the dollar amount.

2.2.2 Final Report - The final report shall be submitted to the Contracting Officer's Technical Representative on or before the thirtieth day following completion of the work under the contract. This report shall cover the entire design and/or development work accomplished during the period of performance and shall contain a section covering the work performed under each of the tasks set forth in the Work Statements. The report shall state concisely but completely the major problems encountered, the apparent cause of the problems, the problem solutions and an evaluation of the solutions based on actual application of the solutions.

2.2.3 Installation Engineering Data - Whenever hardware is a deliverable item under a contract the contractor shall provide the Installation Engineering Data requested on Enclosure 2. The Contracting Officer's Technical Representative shall provide the blank forms to the Contractor. Preliminary data shall be submitted to the Contracting Officer's Technical Representative at six months and again at three months prior to the delivery date of the equipment. Final data shall be submitted by the contractor not less than thirty days prior to the delivery of the equipment.

2.2.3.1 The outline drawing, submitted with the Installation Engineering Data form shall show:

(a) the orientation of the equipment within the work area for normal equipment useage.

(b) the exact location of all external connections.

(c) the clearance required around the equipment for access to all removeable panels, doors, etc.

(d) the location of mounting points and type of mounting required.

2.3. Delivery of Reports - All monthly reports and the final report shall be forwarded by the contractor to the Consignee(s) specified in the contract. The contractor shall forward each report in the number of copies specified in the contract.

2.3.1 The Installation Engineering Data form plus the outline drawing shall be forwarded to the Contracting Officer's Technical Representative.

Statement of Funds as of 30 September 19XX (See Note 1)

EXPENDITURES

1.	Labor:		
	a. Total paid as of 31 August 19XX	XX,XXX	
	b. Paid during September 19XX	X,XXX	
	c. Sub-total		XX,XXX
2.	Material:		
	a. Total paid as of 31 August 19XX	X,XXX	
	b. Paid during September 19XX	XXX	
	c. Sub-total		X,XXX
3.	Services (sub-contracts, etc.):		
	a. Total paid as of 31 August 19XX	X,XXX	
	b. Paid during September 19XX	XXX	
	c. Sub-total		X,XXX
4.	Total expenditures as of 30 September 19XX		XX,XXX

OBLIGATIONS AND ESTIMATES

5.	Obligations:		
	a. Sub-contract W/ABC Co., amount not yet paid	X,XXX	
	b. Sub-contract W/DEF Co., amount not yet paid	XXX	
	c. Material ordered but not yet paid for	XXX	
	Sub-total		X,XXX
6.	Estimates of Future Expenditures:		
	a. Estimate of labor required	X,XXX	
	b. Estimate of material required	XXX	
	c. Proposed sub-contracts	XXX	
	Sub-total		X,XXX
	Total		XX,XXX

Enclosure 1

NOTES:

1. All amounts shown above must include overhead, G&A, handling charges, fees, etc.

Approved For Release 2004/11/30 : CIA-RDP78B04770A000400010006-2

INSTALLATION ENGINEERING DATA

Date form completed ________________

(See Remarks at end of form)

Tentative /___/ Valid until __________

Final data /___/

I. INSTRUMENT
   A. Name of instrument: ______________________________
   B. Manufacturer: ______________________________
   C. Contract number: __________
   D. Delivery date: Tentative: __________ Final: __________

II. PHYSICAL FEATURES
   A. Sub-assemblies:
      1. Number of sub-assemblies: ______
      2. Largest sub-assembly: Weight ____lbs; ____" H x ____" W x ____" D
      3. Heaviest sub-assembly: Weight ____lbs; ____" H x ____" W x ____" D

   B. Assembled instrument:
      1. Number of major components: ______
      2. Largest component: Weight ____lbs; ____" H x ____" W x ____" D
      3. Heaviest component: Weight ____lbs; ____" H x ____" W x ____" D
      4. Total floor space required after assembly, including maintenance access space. ___Ft. ___In. High x ___Ft. ___In. Wide x ___Ft. ___In. Deep.
      5. Total weight of assembled instrument: ______lbs.

   C. Type of base of mount: Flat ___; 3-point suspension ___; 4-point suspension ___

   D. Does the instrument have built-in mobility? Yes ___ No ___

   E. Is the instrument particularly sensitive to vibration? Yes ___ No ___
      Will the instrument generate vibration? Yes ___ No ___

   F. Are any special or unusual tools or fixtures necessary or adviseable for the installation of the maintenance of this instrument? Yes ___ No ___.
      If "Yes," please describe: ______________________________

      ____

III. UTILITIES
   A. Electrical:

	AC	DC
1. Voltage	____Volts ∤ ____Volts	____Volts ∤ ____
2. Current	____Amps/phase	____Amps
3. Frequency	____cps	
4. Nr. of phases	____Ph	
5. Nr. of wires	____	
6. Power required	____Watts	____Watts
7. Power factor	____(Leading) (Lagging)	

   8. Type of outlet: Two prong ___; three prong ___; Twist lock ___; Perm.___
   9. Type of ground: Building conduit ___; Direct earth ground ___.
   10. Should the instrument be shielded, either from external electromagnetic signals or to prevent interference with other equipment? Yes ___No___
       If "Yes," to what extent? ______________________________

       ____

Revised 1/66

B. Air conditioning:

1. Desired environment: Room air temperature of ___ °F / ___ °F and relative humidity of ___% / ___%.
2. Input Air: Is a direct connection necessary? Yes ___ No ___; Adviseable? Yes ___ No ___; If "Yes," what is the connector type and size? _____ Recommended input air temperture ___ °F / ___ °F. Relative humidity ___% / ___%. If input air must be filtered, what is the maximum particle size in microns? ___ What particle count? _____/ cu. ft.
3. Output Air: Is a direct connection to the return air duct necessary? Yes ___ No ___. Adviseable? Yes ___ No ___. Connector type and size? _____. Output air temperature ___ °F / ___ °F. Relative humidity ___% / ___%. Output heat ___BTU/Hr. Flow of ___CFM. Is output air toxic? Yes ___ No ___; Noxious? Yes ___ No ___.

C. Plumbing:

1. Is water required? Yes ___ No ___; Pressure ___PSIG, flow ___GPM.
2. Type of water required:
   Tap ___ °F / ___ °F Deionized ___ °F / ___ °F
   Tempered ___ °F / ___ °F Filtered ___ °F / ___ °F
   If filtered, give maximum permissible particle size in microns and the maximum permissible count. _____ microns _____ particles/cu. ft.
3. Pipe required:
   Galvanized ___ Copper ___ Size _____
   Stainless Steel ___ Plastic ___ Type of connector _____
4. Floor drain:
   Diameter of drain ___ Galvanized drain? ___
   Plastic drain? ___ Glass drain? ___
5. Are any chemical solutions used in the device? Yes ___ No ___. If "Yes," state the nature of the solution(s), permissible temperature range, flow rate in appropriate units and the filtration necessary for each solution _____.
6. Size of pipes and connectors _____.

D. Compressed air:

Is compressed air required? Yes ___ No ___. Water free? ___ Oil Free? ___ Type and size of connector? _____. Pressure ___PSIG. Flow in CFM Maximum ___, minimum ___, average ___.

E. Vacuum:

Is vacuum required? Yes ___ No ___. Pressure ___PSIA or (inches of water) (millimeters of mercure). Displacement in CFM, maximum _____, minimum _____, average _____. Type and Size of connectors _____.

F. Peripheral Devices:

Will the instrument be connected to any peripheral devices such as a computer or data input or data output device? Yes ___ No ___. If "Yes," give, in detail, the nature of the connection to the peripheral device such as coaxial cable, multiple wire connector, etc.

IV. REMARKS

A. Use additional sheets if more space is required for environmental conditions or utilities not mentioned above.
B. Submit three typed copies of the completed form to the Technical Representative.

C. Attach three copies of a dimensioned outline drawing of each major component and of the completed assembly. Include the estimated weight of each major component and of the completed assembly. Indicate, on the outline drawing of the completed assembly, the space required for access to the instrument for maintenance.

D. If a question does not apply to the instrument, insert "N/A" (Not Applicable) in the appropriate blank space.

Information provided by:

_____
(Signature)

_____
(Position or job title)

Specification No. DB-1003
Issue Date: 31 August 1966

GENERAL REQUIREMENTS FOR THE PREPARATION OF TECHNICAL MANUALS

1. SCOPE

1.1 This specification covers the general requirements for the preparation of technical manuals. The requirements of this specification shall apply to manuals which describe the operation of equipment and to manuals which cover the maintenance of equipment.

2. APPLICABLE DOCUMENTS

2.1 The following document forms a part of this specification.
U.S. Government Printing Office Style Manual.

3. REQUIREMENTS

3.1 General - The text shall be factual, specific, concise and so clearly worded as to be readily understandable. It shall:

(a) Provide sufficient information to insure peak performance of the equipment.

(b) Omit discussions of theory except where essential for practical understanding and application.

(c) Reflect engineering knowledge in the most easily understood wording possible.

(d) Avoid technical phraseology requiring a specialized knowledge, except where no other wording will convey the intended meaning.

3.2 Types of Manuals - Two types of manuals will normally be supplied by the contractor on all equipment oriented contracts. The minimum content of each type of manual shall be as specified below and in following sub-paragraphs.

3.2.1 Operators Manual - This type of manual should contain only that information needed to operate the equipment efficiently and safely. The Operators Manual will normally include the following data:

Front matter
Introduction or General Information
Operating Instructions
Operators Maintenance
Emergency Procedures

3.2.2 Maintenance Manual - This type of manual should be written for use by personnel who are qualified technicians in the field of optics,mechanics, and electronics. The purpose of this manual is to provide the necessary instructions to properly perform routine preventative maintenance and to be able to quickly locate and repair or replace defective components. The Maintenance Manual will normally include the following data:

Front Matter
Functional Description
Checkout Procedures
Trouble Shooting Procedures
Servicing
Removal & Replacement Procedures
Repair Procedures
Parts List

3.3 Contents - Manuals shall contain the following data arranged as indicated in paragraph 3.2. Where indicated sections obviously do not apply, or when additional information is required, the proposed changes in coverage or format shall be submitted to the technical representative for approval.

3.3.1 Front Matter - Standard front matter, listed in the normal sequence of appearance, shall consist of the following:

Cover and Title Page - The cover shall contain the information shown in Figure I.

The title page shall contain the information shown in Figure II.

Table of Contents - The table of contents shall list all primary divisions (sections, and sub-sections) with their corresponding page numbers. In multi-volume manuals, each volume shall contain its own table of contents. See Figure III for the suggested format.

List of Illustrations - The list of illustrations shall contain a complete listing of figures, titles, and page numbers. In multi-volume manuals, each volume shall contain its own list of illustrations. See Figure IV for the suggested format.

List of Tables - The list of tables shall contain a complete listing of all tables, titles, and page numbers. In multi-volume manuals, each volume shall contain its own list of tables. See Figure V for the suggested format.

Frontispiece - The frontispiece shall contain a photograph or sketch of the equipment or system. In multi-volume manuals, each volume shall contain its own frontispiece.

3.3.2 General Information - The operators manual shall include an overall description of the functions and purpose of the equipment. This information is intended for use by personnel requiring a general summary of the equipment or system and its performance, advantages and limitations.

3.3.3 Description - The functioning of the equipment or system as a whole and its inter-related units shall be described. The functional description shall be non-technical in nature and shall describe the intended use, capabilities, and the limitations of the equipment or system. Flow diagrams, schematic diagrams and functional black diagrams necessary for understanding system or equipment functions and performing trouble analysis will be included in this section. Text covering physical descriptions, or structural arrangements shall be brief. Special attention should be given to avoidance of unnecessary details that are easily illustrated. A list of equipment supplied, together with the approximate volume, weight, and overall dimensions of each unit, as applicable, shall be included. In addition, a compilation of quick-reference data shall be included. The quick-reference data shall consist of pertinent technical or design characteristics of the equipment. Examples of such data are:

(a) Functional characteristics, such as:

Power requirement
Types of operation
Power output
Frequency
Pulse characteristics
Sensitivity; selectivity

(b) Capabilities, such as:

Rated ranges
Coverage
Resolution
Accuracy

(c) Rated outputs, such as:

Wattages
Voltages
Horsepower

(d) Special characteristics, such as:

Operating temperatures
Pressure
Humidity
Tolerances

(e) Other pertinent characteristics

3.3.4 Operating Instructions - Operating instructions shall contain the essential information required by the operator for normal operation of the equipment or system. This shall include such instructions as are necessary for setting up or preparing the equipment for use, required warm-up procedures, starting the equipment, verifying normal operation, shut down and post shutdown requirements. Where procedures are to be performed in a specific sequence, step-by-step procedures shall be given and shall include any tables or charts necessary to present such procedures. Adequate illustrative material shall supplement the text, to identify and locate all operating control and indicating devices.

3.3.5 Operator's Maintenance - The information provided shall include any maintenance procedures within the capability of an operator. This capability is limited to procedures governing periodic inspection, cleaning, servicing, preservation, lubrication, adjustment, and minor parts replacement (fuses, dry batteries, indicator lamps, and so forth) which do not require the need for internal alignment or complex adjustment.

3.3.6 Emergency Procedures - Emergency procedures shall consist of actions taken in the event of equipment malfunction. Safe shut down and methods of reactivating the equipment shall be included. Detailed step-by-step procedures on specific sequential operations shall be presented in tabular, checklist form to the maximum extent feasible.

3.3.7 Checkout Procedures - Step-by-step checkout procedures required to verify satisfactory operations shall normally be presented in tabular form. The instructions shall clearly indicate why the checkout is performed and what conditions are to be sought. When malfunctions occur, references to appropriate trouble shooting procedures shall be made.

3.3.8 Servicing - Servicing requirements include cleaning, lubricating, replacement procedures and other preventive maintenance procedures which apply to the particular equipment. For systems, reference shall be made to the applicable equipment manuals which spell out various servicing procedures.

3.3.9 Trouble Shooting - The manual shall provide adequate details for quickly and efficiently locating the cause of an equipment malfunction. The discussion shall contain concise information on how the equipment operates. The discussions shall be in order of operational or data sequence, as applicable. Block diagrams, performance curves, and nomographs shall be used to support the discussion whenever necessary. Trouble-shooting information required to localize any trouble to a particular functional division (or unit) shall be included to serve as a guide in isolating faults.

3.3.10 Removal and Replacement Procedures - These procedures shall provide step-by-step procedures for removal and replacement of items which are subject to frequent replacement. These instructions should provide for a judicious combination of text and illustrations. Obvious detail steps should be omitted. If special tools are required they shall be listed immediately preceding the detailed instructions for the job.

3.3.11 Repair Procedures - Only the repair procedures which must be performed in place shall be provided. These instructions shall provide the necessary information to bring the equipment up to the required serviceable standard when it becomes unserviceable. If checkout is required to verify satisfactory operation of the equipment, applicable reference to the appropriate section of the manual shall be made.

3.3.12 Parts List - The parts list shall include identification data covering all maintenance parts, to facilitate ready identification of the parts for replacement and ordering purposes. Standard hardware, structural parts, or other parts which have no maintenance significance shall not be listed. A brief introduction, if appropriate, and the applicable tables listed below shall be included:

(a) The tabulation shall consist of the following data: reference designation, alphabetically-numerically keyed to an illustration or schematic diagram; part name; description or function; and the manufacturer's name and part number.

(b) When appropriate, a list of any special tools supplied with the equipment or required for maintenance shall be provided at the end of the parts list.

3.3.13 Schematic - A schematic wiring diagram shall be provided for electrical or electronic equipment.

3.4 Style -

3.4.1 Grammar - Person and Mode - The third person indicative mode shall be used for discussion and description. The second person imperative mode shall be used for operating procedures.

3.4.2 Rules - Capitalization, spelling, compound words, and punctuation shall be in accordance with the Government Printing Office Style Manual.

3.4.3 Special Instructions - Modifications to the text of the manual shall be in accordance with the following:

NOTE: An operating procedure, condition, etc., which it is essential to highlight.

CAUTION: Operating procedures, practices, etc., which if not strictly observed, will result in damage to or destruction of equipment.

WARNING: Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

When used, cautions and warnings should immediately precede the applicable instructions. Notes, cautions and warnings shall not be numbered.

3.4.4 Definitions -

Change - Modification of information in an existing manual.

Revision - Second or subsequent edition of a manual which supersedes the preceding edition.

Reprint - Second or subsequent printing of a manual without change.

Addendum - Addition to a manual which can be inserted into the proper place in the manual.

Supplement - Subsidiary document which complements information in a manual.

3.4.5 Measurement - Units of measurement shall be those accepted and used in the technical field under discussion; units in the text shall conform to the units used on instruments and other indicators on the equipment.

3.4.6 Pagination - Pagination for the Table of Contents shall be small Roman numerals, i.e., i, ii, iii, iv, v, etc., in lower right hand corner of the page. Pagination for the body of the manual shall be Arabic numerals, i.e., 1, 2, 3, 4, 5, etc., in lower right hand corner of the page.

3.4.7 Security - If a classification is necessary, it shall be assigned on the contract. The appropriate classification shall be centered and printed or stamped 1/2 inch from the top and bottom of the front and back covers and on each page of the manual, including illustrations, in letters 1/4 inch or more high. Other controls and restrictions that are required shall be outlined on a specific basis.

3.4.8 Reference Method - The method of referencing within a manual shall be as follows: to sections - by section number; to tables - by table number; to illustrations - by figure number. If a manual is divided into volumes, the volume number shall be included as part of the reference.

3.4.9 Identification - Section headings shall be centered and numbered consecutively with an Arabic numeral followed by a period and the title in capital letters; e.g.

1. GENERAL INFORMATION. Sections shall start at the margin and be numbered consecutively with an Arabic numeral, which corresponds to the numeral in the section heading, followed by a period, another Arabic numeral consecutively numbered, and the title in capitals and lower case: e.g.,

1.1 Scope. Sub-sections shall start 1/2 inch from the margin and be numbered consecutively in the same manner as the sections with the addition of a period, followed by an Arabic numeral consecutively numbered, and the title in capitals and lower case; e.g., 1.1.1 Special content.

3.4.10 Illustrations - Illustrations shall be identified by a figure number in Roman numerals, and title. The figure number and title shall be positioned immediately beneath the illustration as held in a reading position. In addition, illustrations shall be positioned as near as possible to the applicable text material.

3.4.11 Tables - Tables shall be identified by a table number in Arabic numerals, and title. The table number and title shall be positioned above the table as held in a reading position. In addition, tables shall be positioned as near as possible to the applicable test material.

3.4.12 Page Ending - Pages shall begin and end with a paragraph.

3.5 Reproduction and Production -

3.5.1 Kinds of Reproduction - Whenever practical, manuals shall be reproduced by multilith, letter press or some photo offset means. When the number of copies required dictates a more economical reproduction method, the proposed method must be approved by the technical representative.

3.5.1.1 When the contract specifies that reproducible copy of the instruction manual is a deliverable item, such copy shall be prepared for offset printing. Art work will be supplied in accordance with the applicable paragraphs of 3.6.

3.5.2 Size - Manuals shall be 8 1/2 x 11 inches, unless otherwise specified.

3.5.3 Number of Copies - Unless otherwise specified, one copy of each type of manual shall be provided for each piece of equipment supplies plus a surplus of 50 percent. A minimum of two copies of each type of manual will be supplied.

3.5.4 Paper - The paper used shall be good quality paper appropriate for the reproduction method used.

3.5.5 Covers - Covers shall be of flexible plastic or good quality paper stock. Covers need not include any printed matter (other than security classification) if suitable cut-out windows are provided.

3.5.6 Binding - Manuals shall normally be provided as bound volumes, with saddle or side-stitching. If specified in individual cases or when approved by the technical officer, manuals may be provided in loose leaf form.

3.5.7 Trade Marks - In no instance, except in the Parts List shall the manufacturer's name, signature, symbol, or trade mark appear in the text, cover, or illustrations.

3.6 Art -

3.6.1 Scale - Illustrations shall be to as small a scale as possible with all essential detail legible; be same size as areas they will occupy on the manual page or such oversize as to permit uniform reduction to this size.

3.6.2 Line Art -

(a) Line art shall be of high reproduction quality. India ink or other suitable material capable of maintaining consistent high density tonal values shall be used for preparing the line drawings.

(b) Only copy prints of pencil drawings shall be acceptable. Engineering drawings which may not have been prepared primarily for illustration purposes are acceptable as illustrations if the copy is legible, reproducible and readable when reduced in size.

(c) Line weights shall be of sufficient strength to reproduce clearly at required reproduction size. Parallel lines on wiring and schematic diagrams, as a general rule, shall be not less than 1/8 inch and in no case less than 1/16 inch apart when reduced to printed size.

(d) Secondary lines such as those used to indicate extensions or measurements shall be of lighter weight but strong enough to reproduce clearly at reproduction size. Shading effects shall not be used for decorative purposes or be permitted to distort or destroy the form. Lines, crosshatching or patterns used for shading shall be of sufficient size to withstand the process of reduction to reproduction size.

3.6.3 Continuous Tone Art - All art containing tonal values of grey as well as black, which is not created by lines or dots, shall be considered Continuous Tone Art. Such art, whether photograph or drawing, shall be clear in

detail, sharp in contrast of tones and with light and shadow in proper relation to the actual light source. Separation of planes shall be shown by differences in tonal values rather than by lines.

3.6.4 Retouching - Photographic retouching shall be held to the absolute minimum by utilizing good photography to clarify planes by tonal separation, emphasize essential detail, correct slight camera defects and eliminate undesirable shadow. Quality shall be such that tonal values are held when reproduced.

3.6.5 Additional Requirements for Photography - Glossy prints shall be made from crisp, clear, well-exposed negatives. They shall be detailed and sharp, be free of heavy shadows, distorted objects, cluttered foregrounds or backgrounds, and give good contrast from white, middle tones and black.

3.6.6 Combination Art - Representation of a subject by combining line and continuous tone art shall be limited to where this treats the subject better.

3.6.7 Tables, Charts, Graphs - The use of tables, charts, graphs shall be considered and handled as illustrations whether produced in line, halftone or tabular form.

3.6.8 Cartoons - Cartoons and similar material shall only be used in manuals when authorized by the technical officer.

3.6.9 Tints and Patterns - Tints, patterns, cross-hatching, dots, etc. in black and white shall be used in lieu of colors.

3.6.10 Fold-out Sheets - Fold-out sheets shall be used only when the material cannot be satisfactorily presented on a single page.

3.6.11 Cropping and Marking Art - Separate art shall have the reproduction area defined on all four sides by crop marks which shall extend at least 3/4 inch beyond illustration. The exact reproduction size shall be indicated between the required marks.

3.6.12 Marking Art for Identification - Art shall bear the figure number, title, security classification, if required, and page number, when it comprises a full page.

3.6.13 Defining Direction of Art Placement - All art shall have the top clearly marked. Identification shall be outside the reproduction area.

3.6.14 Callouts on Art - Callouts on art shall be used when necessary to explain or identify significant features or components. Index numbers shall start with Arabic number 1 and run consecutively. Sequence shall be from top to bottom or clockwise. Nomenclature on line art of more than one line shall have the left-hand margin justified.

3.6.15 Keying Index Numbers - When index numbers are used, a key consisting of the numerical listings and their corresponding nomenclatures shall be included in (or adjacent to) the art. Keys used outside art shall be below or adjacent to art and precede figure number and title.

3.6.16 Callout Lines - Lines shall be uniform, short and straight as possible. They shall end close to callout and object. Lines shall not cross or come in contact with other lines nor shall they obscure essential details.

3.6.17 Instructions in Procedural Illustrations - Procedural illustrations shall have one or more brief text steps with each illustrated step. The text shall be as close to the illustrated step as possible. Steps shall be numbered consecutively in Arabic numerals in the order in which they are to be accomplished, beginning with Arabic number 1.

3.6.18 Mounting Art - Separate art shall be rendered or mounted on board of two ply or more. Dimensions of the mount shall include a minimum border of 3/4 inch on all four sides of the illustration area.

3.6.19 Covering Art - Continuous tone art shall be protected by an outer flap of heavy paper and an inner flap of tissue or vellum. Line art shall be protected by outer cover only.

3.7 Mechanical Features - Manuals shall be prepared in accordance with the mechanical specifications outlined in Table 1.

3.8 Quality Control Provision -

3.8.1 Preparation - An outline shall be prepared which gives a detailed breakdown of all elements to be covered including planned charts, tables, schematics, and other illustrations. The outline should be discussed with the technical

representative and a manuscript developed which shall be submitted for approval as soon as possible or at least 30 days before completion of the production sample. In all cases, the proposed manuals shall be received and approved by the technical representative before final printing.

3.8.2 Inspection - Manuals shall be inspected to determine compliance with the requirements of this specification and for equivalence with the approved manuscript. In addition, the content of the manual shall be checked against the equipment being furnished to assure that it depicts accurately and adequately the equipment and the operating and maintenance procedures required.

3.9 Packaging and Shipment - Manuals shall be packaged separately in bulk and shipped to the same address and at the same time that the equipment is shipped. Manuals shall be packaged in containers which comply with the carrier regulations applicable to the mode of transportation. If manuals are classified, shipments shall be in accordance with security regulations.

3.9.1 Shipment of Reproducible Materials - Art work and reproducible text material furnished by the contractor shall be packaged in containers which comply with the carrier regulations applicable to the mode of transportation, and shipped to the address indicated in the contract or supplied by the technical officer. If material is classified, shipments shall be in accordance with security regulations.